



Written Testimony of

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Chairwoman Velazquez, Ranking Member Graves and members of the Committee, thank you for the opportunity to speak before you today on how small business can and is currently addressing climate change. My name is Gordon Sharp, and I am the Chairman and founder of Aircuity, Inc., a small business company located in Newton, Massachusetts that has developed innovative technology for enabling greater commercial building energy efficiency and reduced green house gas emissions.

In terms of my personal background, for over 25 years I have been an active entrepreneur founding and growing small businesses involved with developing and commercializing innovative technology for commercial and institutional buildings. I am a graduate of MIT and also hold over 25 US patents primarily related to inventions that reduce demand for energy used by a building's HVAC (Heating, Ventilating and Air Conditioning) systems.

My background is representative of the role that small businesses can and have played in developing innovative technologies to solve existing market problems. This is certainly true when it comes to climate change as there are countless small businesses working to develop and commercialize technologies for everything from renewable energy sources such as solar, wind, biomass and geothermal to the capture, sequestration and mitigation of CO₂ and methane gasses to improved energy efficiency of existing residential and commercial buildings.

Aircuity is focused on providing commercial building owners with a cost-effective means to reduce the amount of energy required to heat, cool and ventilate their buildings. As a whole, buildings represent the single largest category of energy use and greenhouse gas emission generator. Of that, commercial buildings account for 36% of all electricity consumed and 18% of US primary energy end use. Within total commercial building energy use, the largest category is HVAC which has grown to more than 33% of total use as the energy savings from decades-long energy lighting retrofits have reduced the percent of energy being consumed for building lighting. Today commercial building HVAC energy efficiency remains one of the most compelling opportunities to achieve near-term impactful climate change. Many small businesses are attacking this opportunity from a variety of vantage points, whether it be through services such as energy audits and retro-commissioning, or the development of advanced HVAC equipment technologies such as electronic filtration or high-efficiency heat exchangers, or with technology such as Aircuity's that enables commercial building ventilation systems to work as designed for energy savings without sacrificing occupant, comfort, health or productivity.

Today I would like to provide two examples of small businesses that are having an impact on climate change as well as to share some of my experiences, successes and the challenges of being a small business in the field of building energy efficiency. Finally, I will provide you some recent market feedback on the growth and interest in this field.

Overview of Aircuity, Inc and It's Energy Savings Solutions

Aircuity was formed in 2000 as a spinoff from the Phoenix Controls Corporation, another small business that I founded and for which I was President and CEO and later sold to Honeywell. Whereas Phoenix Controls, which will be discussed later, represents a mature small business that was acquired by a large multinational, Aircuity represents a younger small business with about 30 employees that is now moving into a rapid growth stage. Our core product is a commercial building energy and environment information system that is used to implement energy efficiency solutions and services that can also help to improve the quality of the indoor environment. Our main focus is on optimizing building ventilation and the use of outside air in all types of commercial facilities such as office buildings, educational facilities, laboratories, healthcare and public assembly related facilities. The control and use of outside air and ventilation represents the single largest controllable factor affecting HVAC related building energy efficiency and its indoor environmental performance.

At the heart of Aircuity's technology is its OptiNet multiplexed sensing system for which Aircuity received an R&D100 award for innovation and social impact in 2006. This innovative technology changes the economics and reliability of sensing the indoor environment by taking sensors such as carbon dioxide, humidity or even dust/particulates and odor/VOC's (Volatile Organic Compounds) out of the room environment that is to be sensed. Instead a patented networked air sampling architecture, routing air packets the way data networks route data packets, is used to sample as many as 20 or 30 rooms sequentially with just one set of high quality sensors in a multiplexed fashion. This approach addresses the well-acknowledged failures of conventional sensing approaches to successfully enable several cost effective existing and new solutions to make building ventilation more energy efficient.

For example, offices, classrooms, healthcare facilities, and public assembly rooms such as this hearing room can benefit from an approach we call healthy demand control ventilation. Rather than use a fixed amount of outside air ventilation regardless of the number of people in a room, this approach varies this ventilation based on the number of people in the space through sensing carbon dioxide levels. Additionally, other parameters such as dust and particulates as well as odors can be sensed to provide additional fresh air when it may occasionally be needed. Since many spaces often have far less people in them then the peak levels to which they were designed, considerable energy can be saved by not flooding these spaces with excess conditioned outside air. Typical paybacks for these solutions range from 1 to 4 years.

Another very impactful energy efficient solution we enable is for research laboratories. By way of background, laboratory facilities require very large amounts of outside air for ventilation and exhaust of chemical vapors. This outside air must be cooled and or heated, supplied into, and exhausted from the building all of which consumes a lot of energy. As such these facilities are

extremely energy intense and require 5 to up to 10 times the energy per square foot of an office building. For example, on many college campuses research laboratories consume 10 to 40% of the total campus energy consumption.

In laboratories we apply a similar demand control approach that is based on sensing the presence or absence of air contaminants in the lab room's environment. This novel air quality based demand control approach can safely reduce the use of outside air in laboratories by over 50% from currently used levels. With Aircuity, high levels of outside air are only used when needed. This intelligent sensing approach reduces lab ventilation to safe minimum levels for over 97% of the time since the air in a research lab is often quite clean and it is wasteful to dilute clean air with more clean air. Typical paybacks for our systems in labs range from under one year to about 2.5 years.

Although our products are often used by larger organizations to create green and high performance buildings we usually sell our products directly to independent sales representative firms that are also small businesses that then resell the product as well as commission and provide annual services for it. Furthermore other small businesses are typically involved in the installation of this equipment and in building retro-commissioning (for existing buildings), further increasing the economic and job creation impact of these systems.

In terms of climate change, the impact of the products that should make up just our expected 2009 calendar year bookings should save our customers conservatively about \$7.5 million annually in energy consumption. This represents an annual savings of 38,700 metric tons or 85 million pounds of CO₂ and is equivalent to the impact of 30.5 Megawatts of solar PV capacity that would cost about \$225 million to purchase and install and is about 7.5% of the solar PV capacity installed in 2008 in the US. The future potential in this market area is enormous for which we are just beginning to scratch the surface.

As an example of our greenhouse gas impact from late last year, we booked an order to retrofit our systems into over 10 buildings at Arizona State University. Included in this are the Biodesign A and B lab buildings that are LEED Platinum green buildings and won the 2006 R&D lab of the year award. ASU has estimated that these two buildings can save over \$1 million of energy a year or a carbon footprint reduction of over 5,000 Metric tons of CO₂ (11 million pounds of CO₂) or the equivalent of about 1,000 cars or the energy used by about 425 homes.

Another example is the University of Pennsylvania, which among a large list of potential sustainability measures to reduce greenhouse gas emissions put Aircuity at the top of it's list in terms of carbon footprint reduction and positive economic impact due to a fast payback from energy savings. In fact when Secretary Chu toured UPenn as part of a recent conference on green jobs with Vice President Biden, Secretary Chu was told about Aircuity and was interested

enough to ask for a follow-up conference call to get more details on our approaches to save energy.

In addition to developing products to save energy, Aircuity is also working with its landlord to green its facility through, for example a completed demonstration project involving a white or cool roof area as well as a small green or vegetated roof area that we show to visitors of our facility. We have also invested into an engineering and architectural design project to develop the most sustainable office fit-out project ever done that also likely involves the largest number of energy efficient HVAC systems and design approaches ever used in one building. Although we are not yet ready to build this facility we have leveraged these efforts to educate others about the concepts used in this design through presentations such as at last year's Greenbuild, which is the USGBC's annual green building conference.

Brief Overview of Phoenix Controls, a "Mature" Small Business

As mentioned above Aircuity was formed as a spinoff from the Phoenix Controls Corporation in 2000 which I founded in 1985 and had sales in 1998 of about \$25 million. If not for being a subsidiary of Honeywell today it would by its size still be considered a small business. It is a world leading manufacturer of unique and innovative airflow controls that also safely reduce the demand for outside air in laboratory research and healthcare facilities.

At Phoenix Controls we developed new technologies that made a first step to safely reducing the use of outside air upon which Aircuity has further improved for even greater savings. However, Phoenix Controls technology alone has made a significant impact on reducing the carbon footprint of these facilities. In fact, the current installed base of Phoenix energy efficiency airflow controls is saving approximately \$1.1Billion of energy savings annually equal to a carbon footprint reduction of 5.6 million metric tons of CO₂. This is equivalent to the average climate change impact of 4.5 Gigawatts of solar PV panels or the energy equivalent of 1 ¼ days of imported foreign oil. Furthermore, the current annual sales of Honeywell's Phoenix Controls subsidiary alone had a climate change impact approximately equal to the impact of the 400 Megawatts of solar PV capacity that was newly installed in the US in 2008.

Common Objections to Energy Efficiency Solutions

When it comes to putting in energy efficient solutions into new or existing buildings, a common objection that is raised is the increase in cost that these solutions including our own systems can potentially add to a building. This objection can be used to veto these additions particularly when the decision is being made by project management staff that do not have a larger fiscal view of the project or have budgets that did not originally contain funding for these solutions. In reality, energy efficiency solutions that have even 5 year paybacks are excellent financial

investments with IRR's of 15%. On the other hand a 2 year payback has an IRR of almost 50%. These are all very good investments that also have the bonus of reducing greenhouse gases.

For anyone who truly looks at the financial returns from energy efficiency the issue of cost is a red herring since the economics and life cycle benefits are often very positive and typically better than those of renewable energy projects. Another reason these solutions may not be approved is perhaps that the extra capital is not available, however in a normal economic climate; reasonable paybacks can be financed in numerous ways.

As a result, the more likely reason is that the building owner is concerned that the projected savings are not real, the equipment does not function as advertised, it will create new problems of some type, or that other costs such as increased maintenance may significantly reduce these savings. Most of these issues are relevant to new and emerging vs. established energy efficiency solutions since the potential customer may have limited or no experience with the energy efficiency solution or there is a lack of a large number of sufficiently credible reference installations that the owner can investigate.

Unfortunately most new technologies and energy efficiency solutions are created by small businesses that additionally lack the credibility, established contacts, and financial resources to establish the many pilot and reference projects needed to prove out the solutions and move through this period from early adopter to mainstream market. This is also known as crossing the chasm. As I have experienced personally with my own innovative technologies and solutions, as the expression goes, "pioneers are the ones with the arrows in their backs".

Lastly, there is one other reason why even proven energy efficiency solutions and projects are cancelled or passed over. This is frankly related to the fact that some organization's have a lack of interest in cutting operating costs due to a predominate organizational focus on growing top line growth with much less interest on containing and reducing operating expenses. As such, energy efficiency projects never get to the top of the list of initiative to pursue even when they have proven and very positive financial returns.

Helping Small Energy Efficiency Related Small Businesses Cross the Chasm

Due to the perhaps healthy skepticism of new energy savings solutions introduced by small businesses, many organizations will discount the projected energy savings by some factor making it harder to reach the organization's financial hurdle rate for these projects. Once the technologies and products have been piloted and tried out the discount factor is reduced and it becomes much easier to have projects approved. One means to counter this initial resistance is to use available incentives and rebates from utilities or from the government to reduce the financial barriers to these initial or pilot projects. Over time these incentives become less

important as the new technologies become more proven and accepted. Carbon credits may also potentially provide another means to sweeten the pot for these projects.

Current Feedback on Market Perceptions of Energy Efficiency and Climate Change

The change in the market's assessment and attitudes regarding energy efficiency over the past several years has been dramatic. When Aircuity's technology was commercially introduced in 2005, most of the focus in what we call the clean tech space was around renewable and alternative energy sources. The technology innovation drive was to develop better sources of energy to replace fossil fuels. However, with renewable energy initiatives and alternative fuels years away from commercialization, the industry's focus has turned to energy efficiency (making existing commercial buildings use less energy to operate) as the most impactful means of achieving a meaningful overall reduction in energy consumption and green house gas emissions. Aircuity's business has nearly tripled year-over-year due to both the cost-effectiveness of our solution and the market's conviction of the benefits of energy efficiency. While we remain a small business in terms of employees (currently 34) and revenues, the pace of our growth continues to accelerate due to several important factors.

First, is the increased number of installed Aircuity sites which now numbers more than 70 and includes some of the most prestigious owners of commercial and institutional buildings. Second, is the clear policy mandate from CEO's and college and university presidents to make carbon footprint reduction to combat climate change a priority. The American College & University Presidents Climate Commitment now involves over 620 universities committed to serious efforts to reduce their energy consumption and carbon footprint. The private sector is equally engaged in the efforts around climate change as major corporations and real estate firms are investing capital to effect energy savings and green house emission reductions. Third, is the economic driver of a declining top line in corporate revenues and non-profit endowments. Due to the new recessionary economy, organizations are increasingly focused on sustainable cost savings. The reduction in energy spend through cost-effective energy efficiency measures has become an effective tool in this drive for cost reduction.

Further evidence of these effects can be seen in the literally exponential growth of the green building movement as initially promoted by the USGBC (US Green Building Council) and now by many other organizations such as ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) and the AIA (American Institute of Architects) who also have major initiatives and efforts to address climate change. In the last 4 years the value of green building construction has gone from about 2 % to a level approaching almost 10% of new construction starts. By 2013, McGraw-Hill Construction estimates today's overall green building market to more than double, reaching between \$96 - \$140 billion versus \$36-\$49 billion today for residential and nonresidential buildings.

Conclusion

Technology innovation will continue to be the driver for overall climate change and small business remains the engine of that technology innovation as entrepreneurs team up with private and public investors to deliver tangible benefits to the markets they serve. There has never been a more important time for small businesses and entrepreneurs to pursue innovation for new as well as existing technologies that can deliver real energy benefits and sustainable climate change. Appropriate and well conceived government based incentives can potentially help these entrepreneurs and small businesses accelerate the product development cycle to full commercialization of meaningful new technologies at a time when it matters most.

Aircuity is proud to be one of many small businesses working to deliver cost-effective solutions to energy efficiency and climate change within the markets it serves. I want to thank the Chairwoman Velazquez and Ranking Member Graves and the Committee for the opportunity to appear here today and I would be happy to answer any questions that you might have.